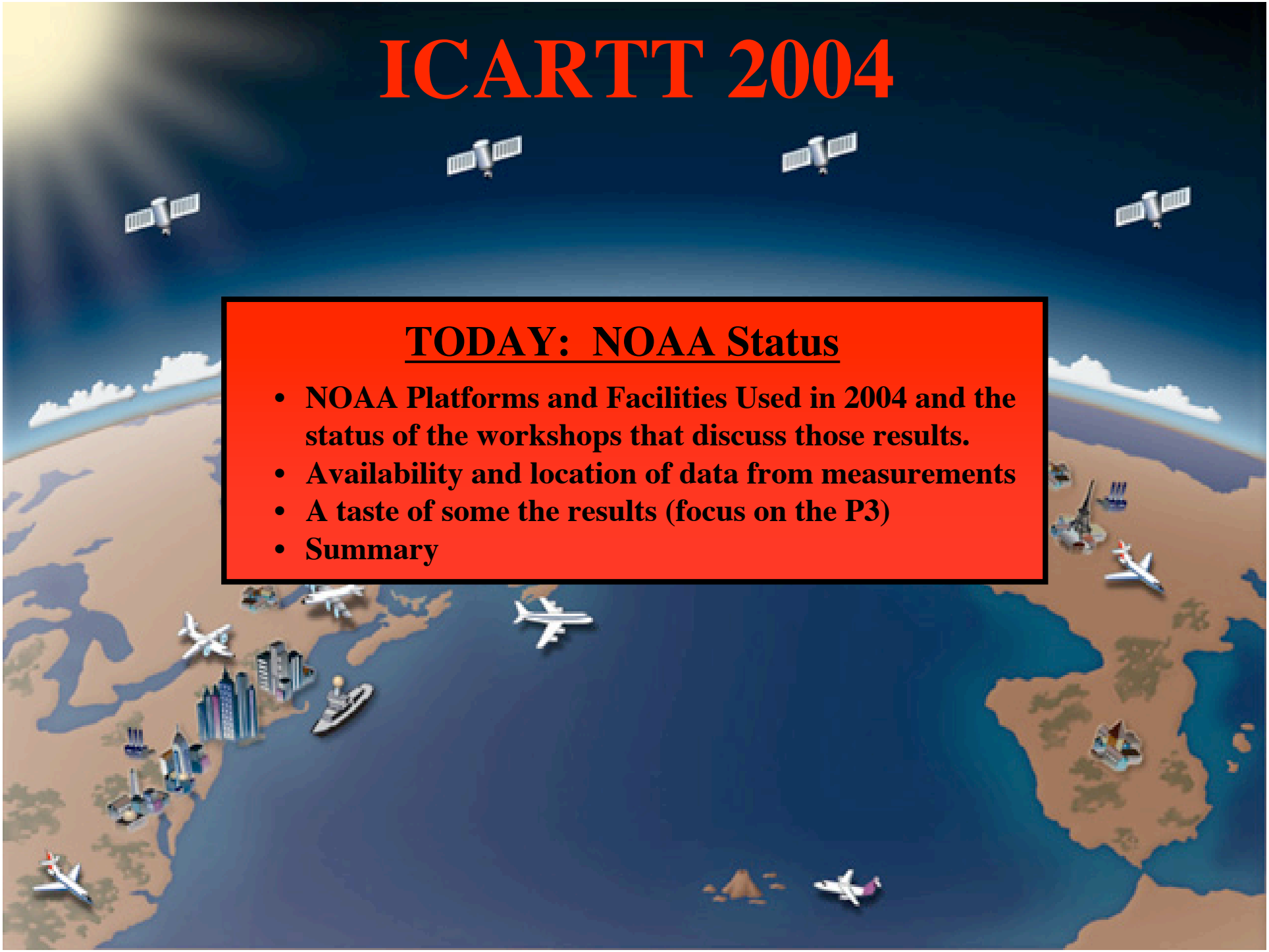
ICARTT 2004

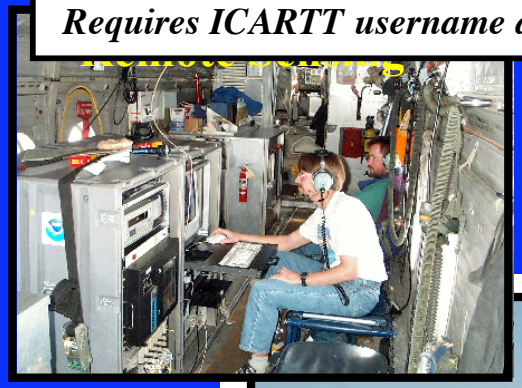


TODAY: NOAA Status

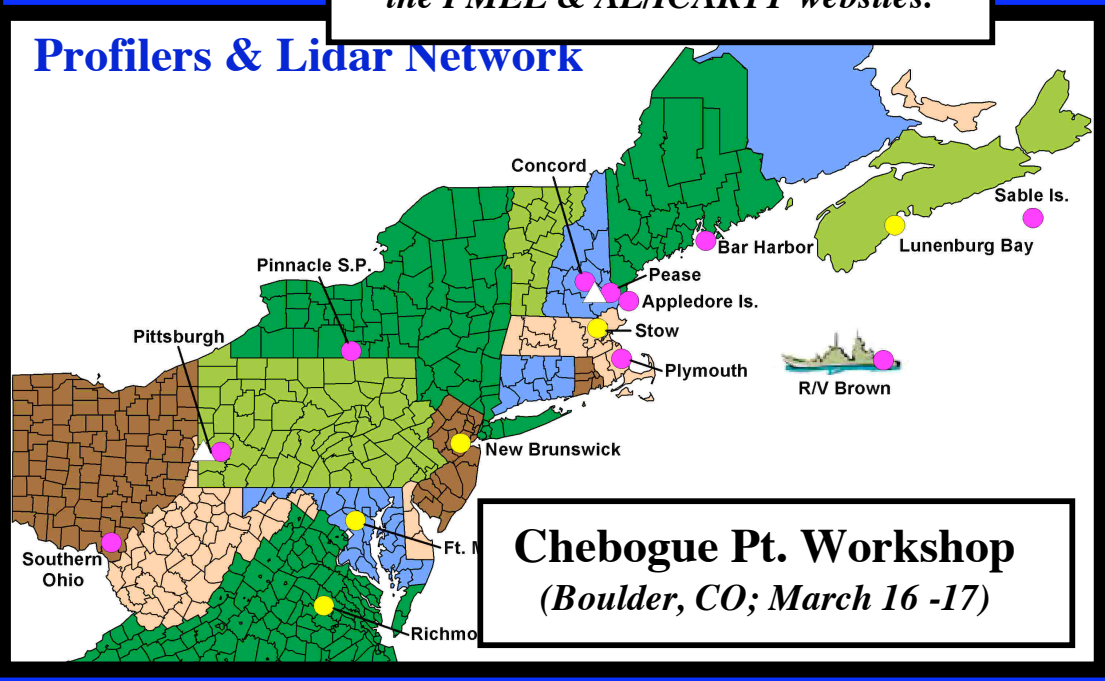
- **NOAA Platforms and Facilities Used in 2004 and the status of the workshops that discuss those results.**
- **Availability and location of data from measurements**
- **A taste of some the results (focus on the P3)**
- **Summary**

NOAA Platforms and Facilities Available in ICARTT 2004

WP-3D/DC3 Workshop
(Boulder, CO; April 11 - 13)
Data available on AL/ICARTT website.
Requires ICARTT username and password.



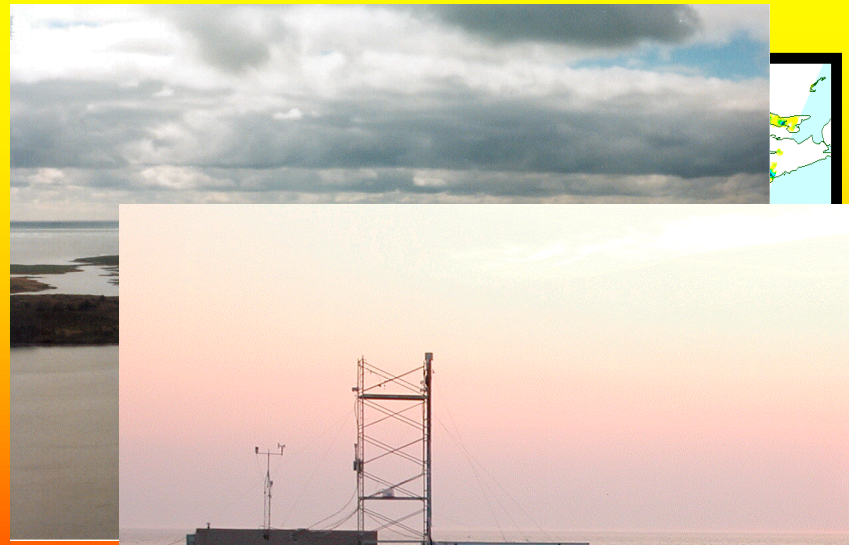
***Ronald H. Brown* Workshop**
(Boulder, CO; March 15 -16)
Presentations and data available on the PMEL & AL/ICARTT websites.



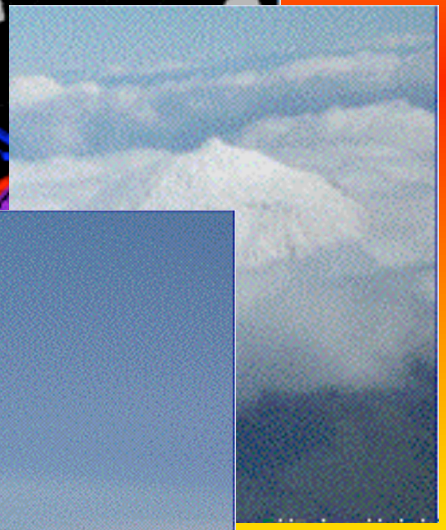
Chebogue Pt. Workshop
(Boulder, CO; March 16 -17)

NOAA and NSF

Chebogue Point: Location and site



Pico: Location and site



Chebogue Pt. Workshop

(March 10 and 11)

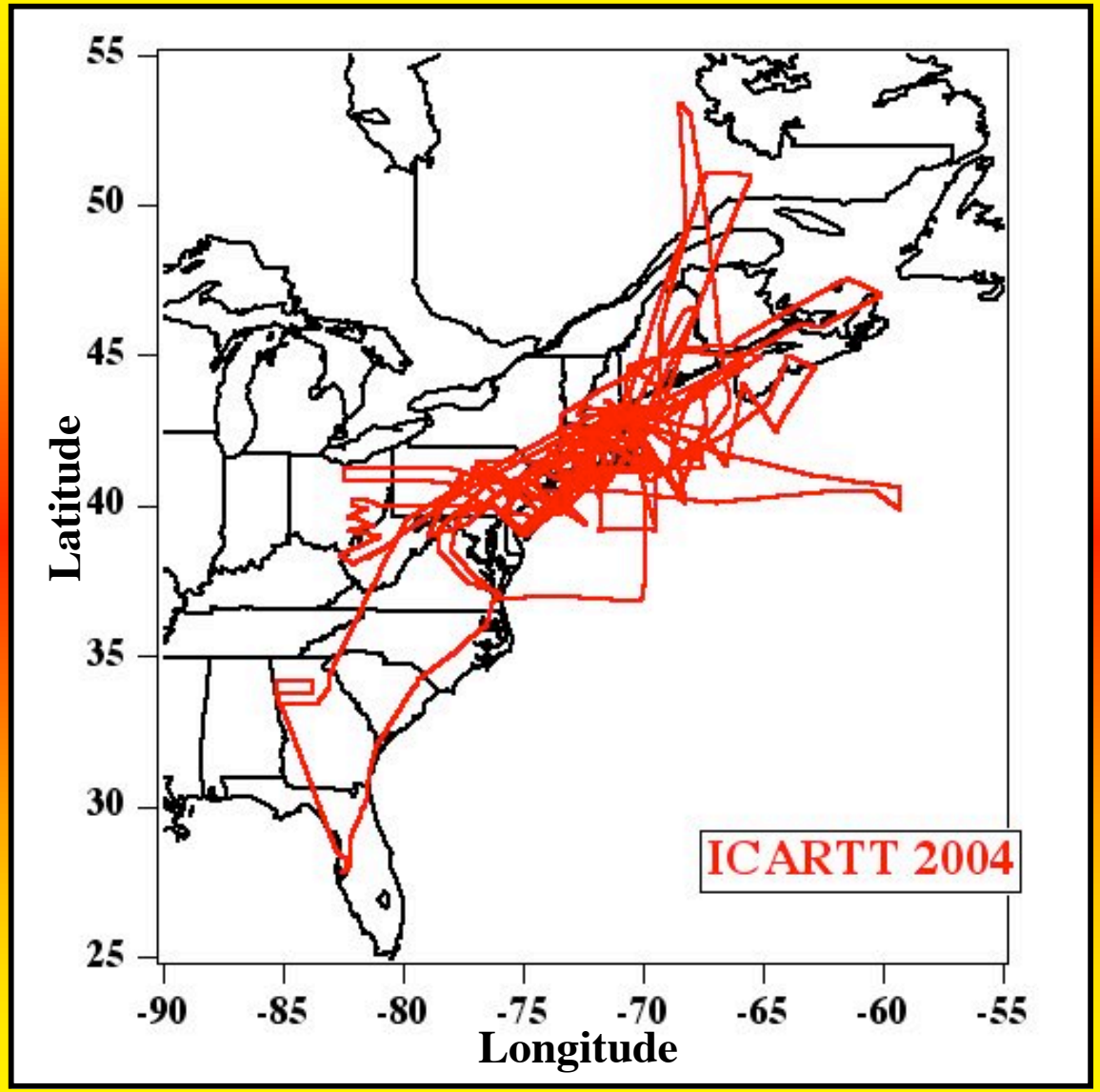
The Chebogue Point presentations (in pdf format) and data are available at Chebogue Pt. ftp site:

- ***Host: ftp.al.noaa.gov***
- ***User ID: chebpt***

NOAA WP-3D Research Aircraft

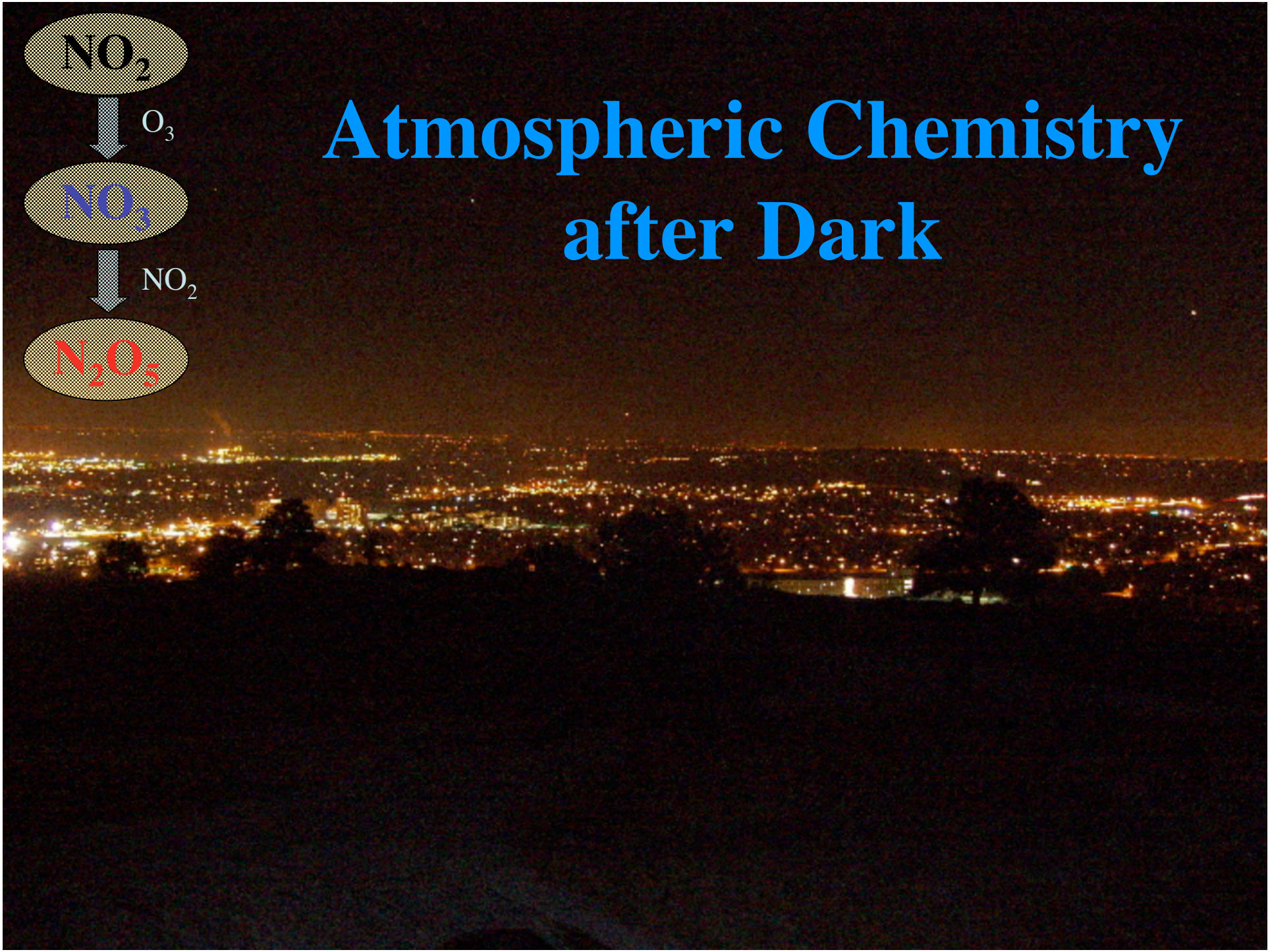
A Taste of Some the Results from 2004

A Taste of Some the Results from 2004



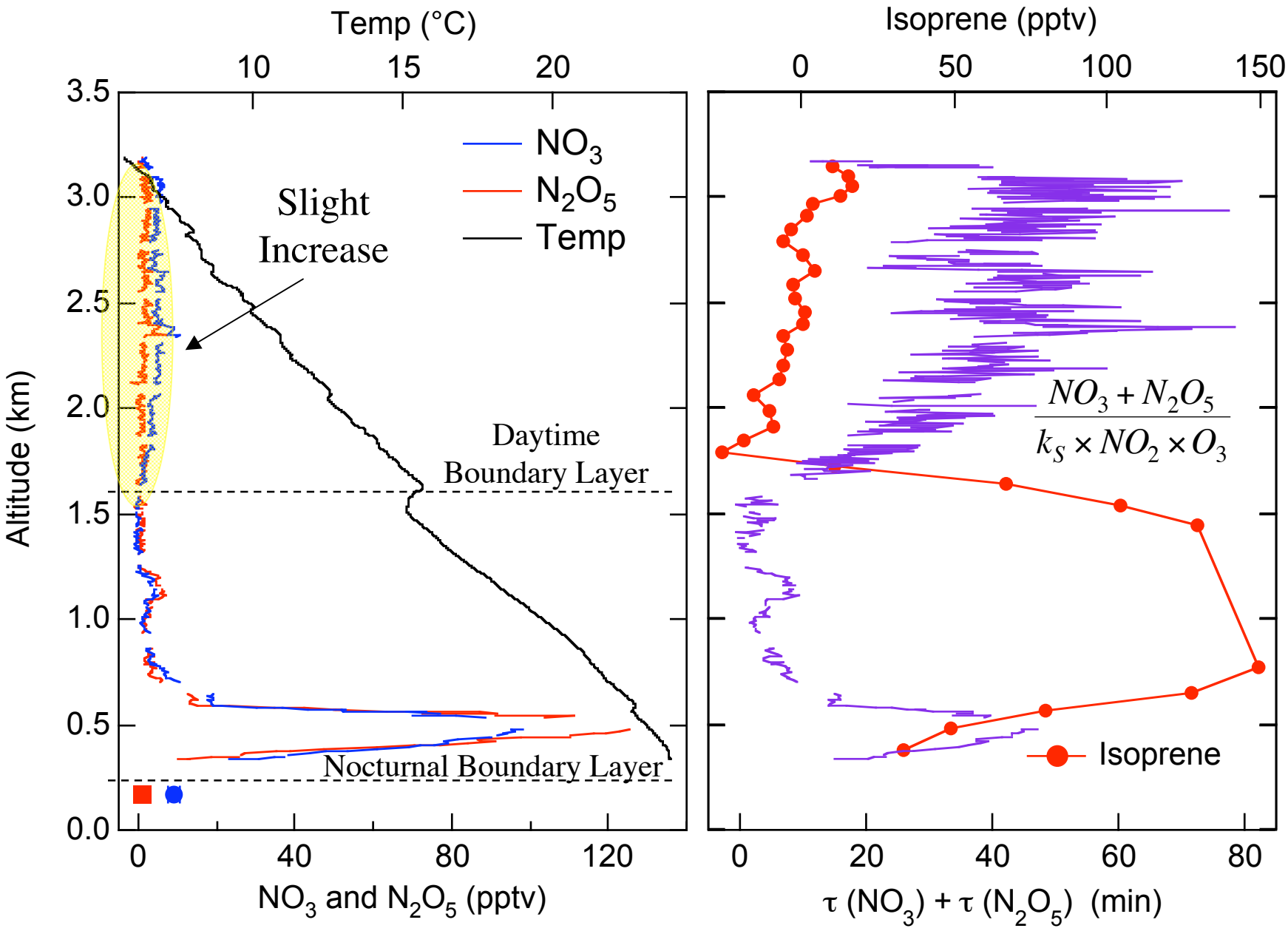
During ICARRT Eighteen Flights (~ 130 hrs.) Studying:

- ***Urban plumes (day and night)***
- ***Power plant plumes***
- ***Forest fire plumes***
- ***Regional composition and chemistry***
- ***Forecast model evaluation***
- ***Long-range transport***
- ***Intercomparison activities***



Atmospheric Chemistry after Dark

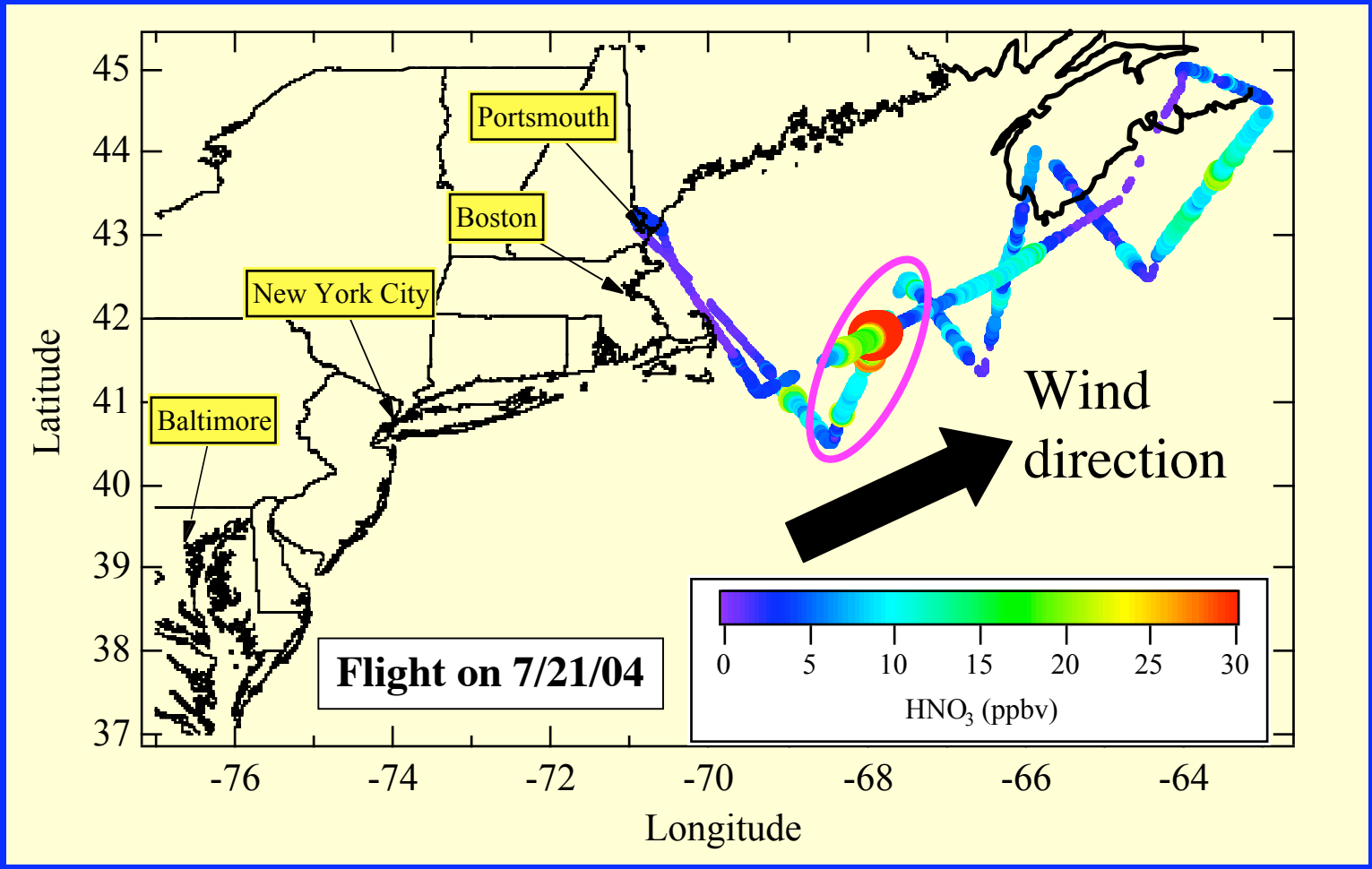
Vertical Profile Over Appledore Island - Aug 3, 2004



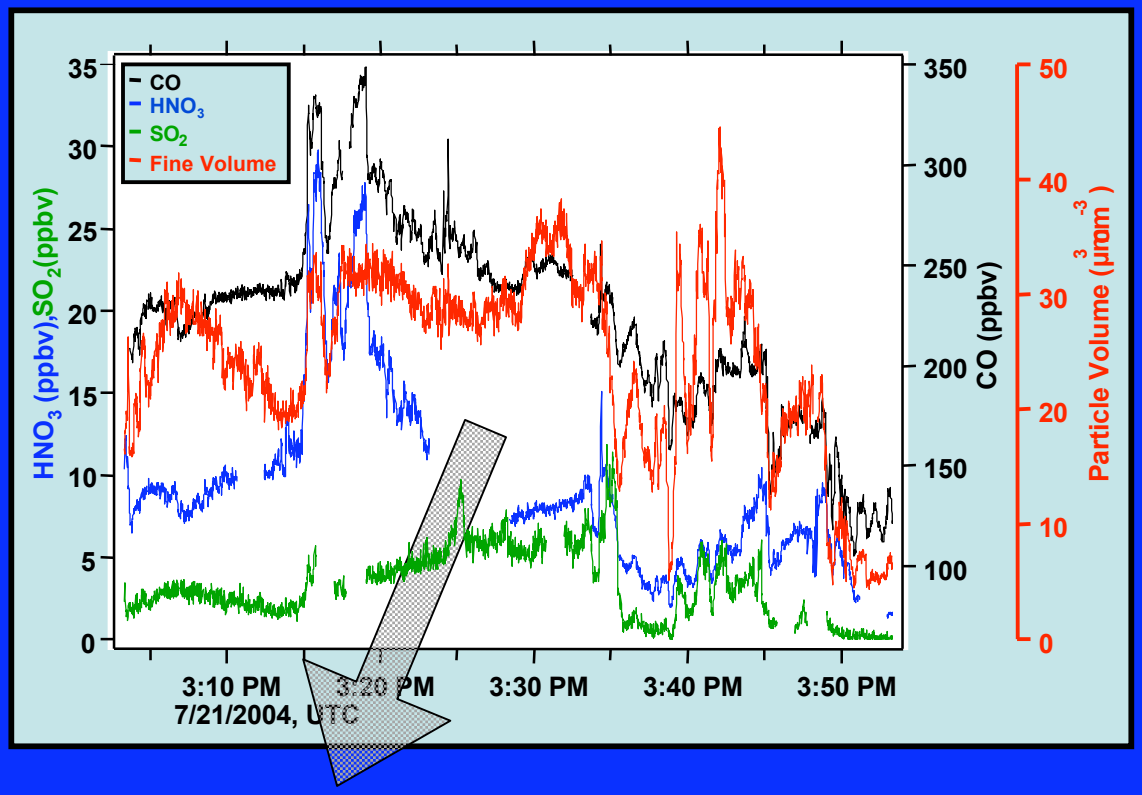
Tracking East Coast Oxidation Products over the Atlantic

Data from flights on July 20, 21, 22.

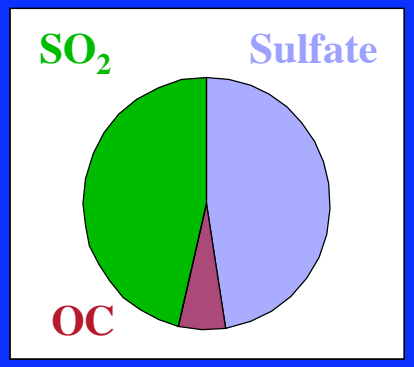
CO, HNO_3, SO_2, aerosol measurements from NOAA WP-3D.



Pollution plumes over the Atlantic



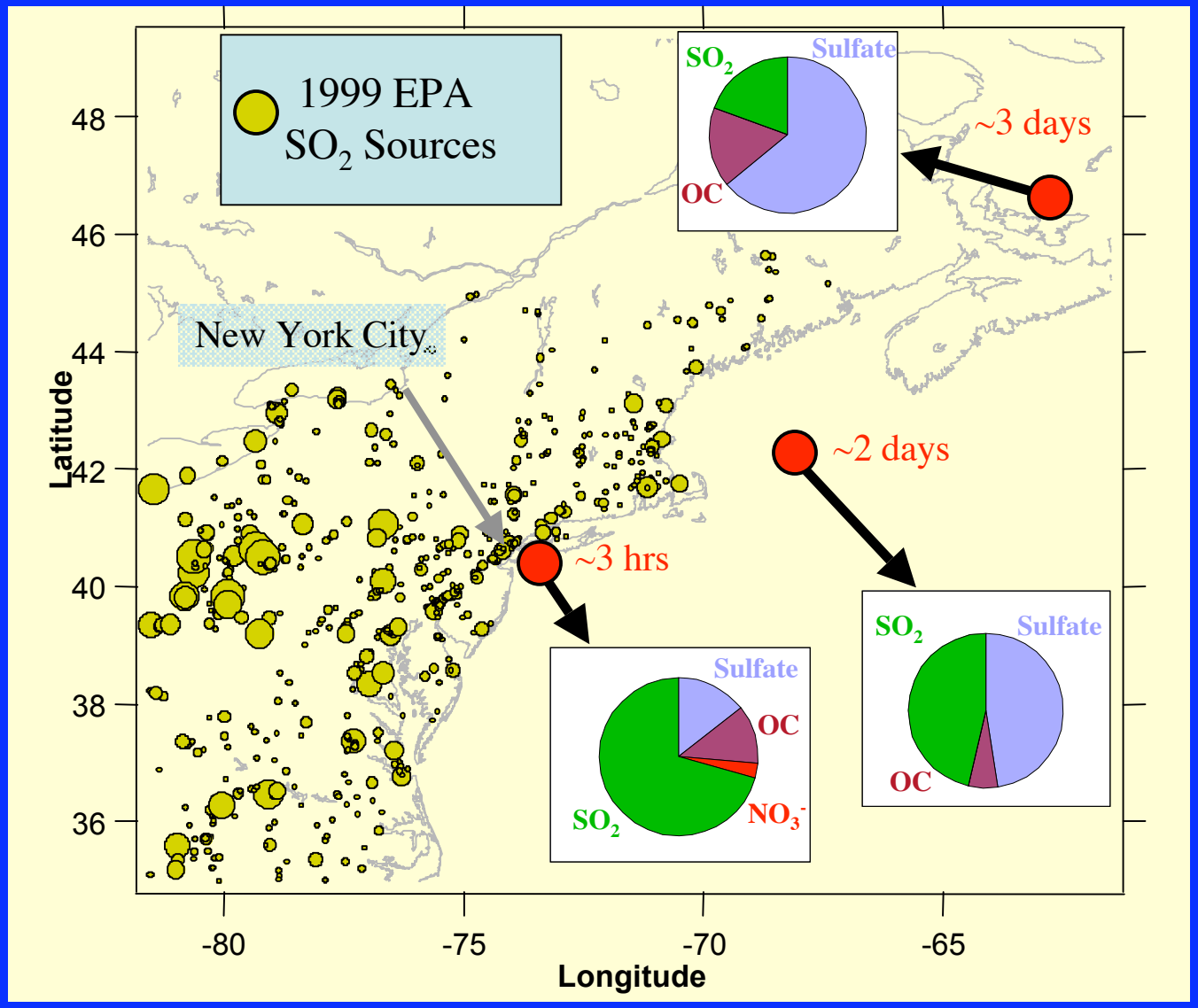
- The CO reflects crossing a mixture of East Coast sources.
- HNO_3 was the most abundant reactive nitrogen species and correlated with CO. *(flexpart retro-plume analysis indicates ~ 2 day transport time).*
- SO_2 not highly correlated with CO.
- SO_2 and fine particle volume are well correlated and greatly enhanced in plume.



- Most of the fine particle mass is sulfate (PILS, R. Weber, GIT).
- Water-soluble organic carbon (PILS, R. Weber, GIT) is generally < 15% of the fine mass; suggests < 30% total organic contribution. (OC estimated from WSOC*2.25.)

Particulate sulfate and potential particulate sulfate (from SO_2) dominate aerosol mass.

How does aerosol composition change with aging plume?

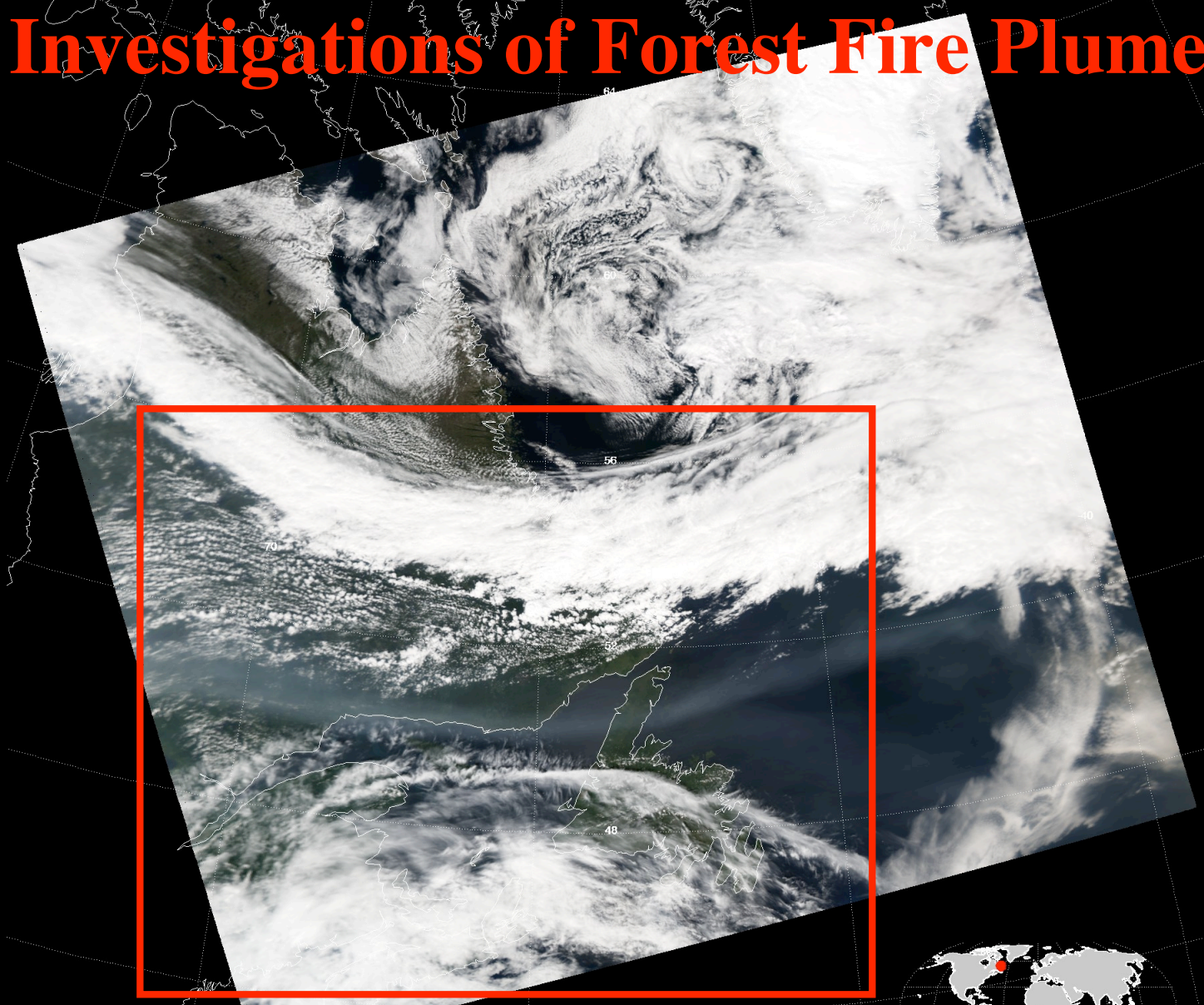


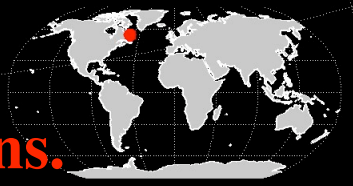
- Many SO_2 sources embedded along urban corridor.
- Plumes crossed on 7/20-21-22.
- Flexpart retro-plume analysis indicates E. Coast sources
- Total OC fraction < 30% fine particle mass (OC fraction estimated from WSOC).

Sulfate and Potential Sulfate (SO_2) Dominate Exported Fine Particle Mass

MYD021KM.A2004210.1635.004.2004211165449.hdf
Aqua MODIS Truecolor Scene

Investigations of Forest Fire Plumes



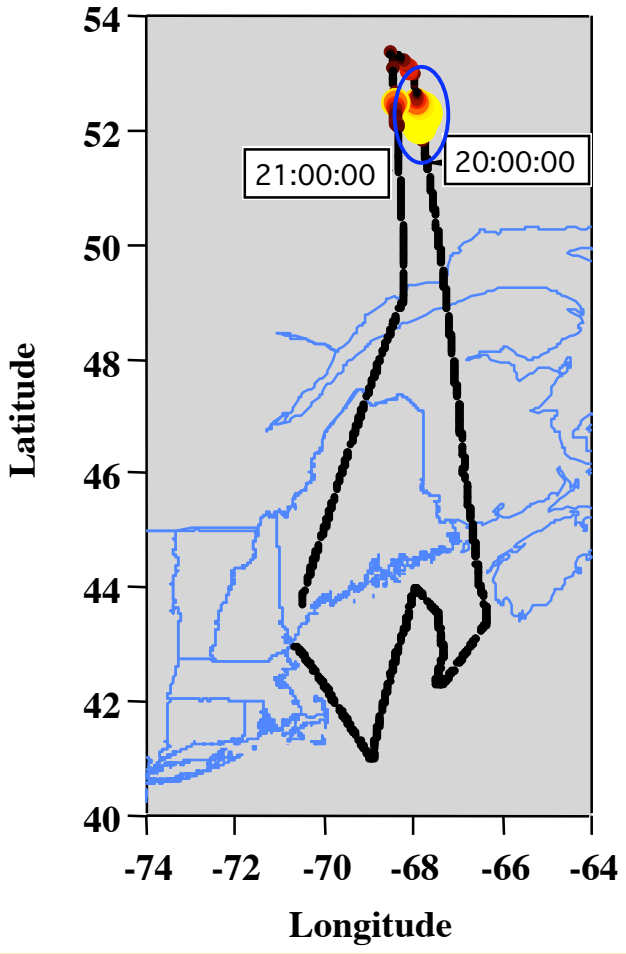


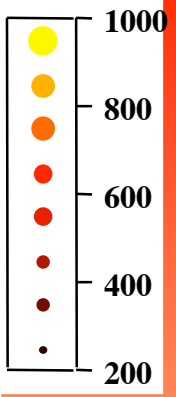
Very Interesting but many questions.

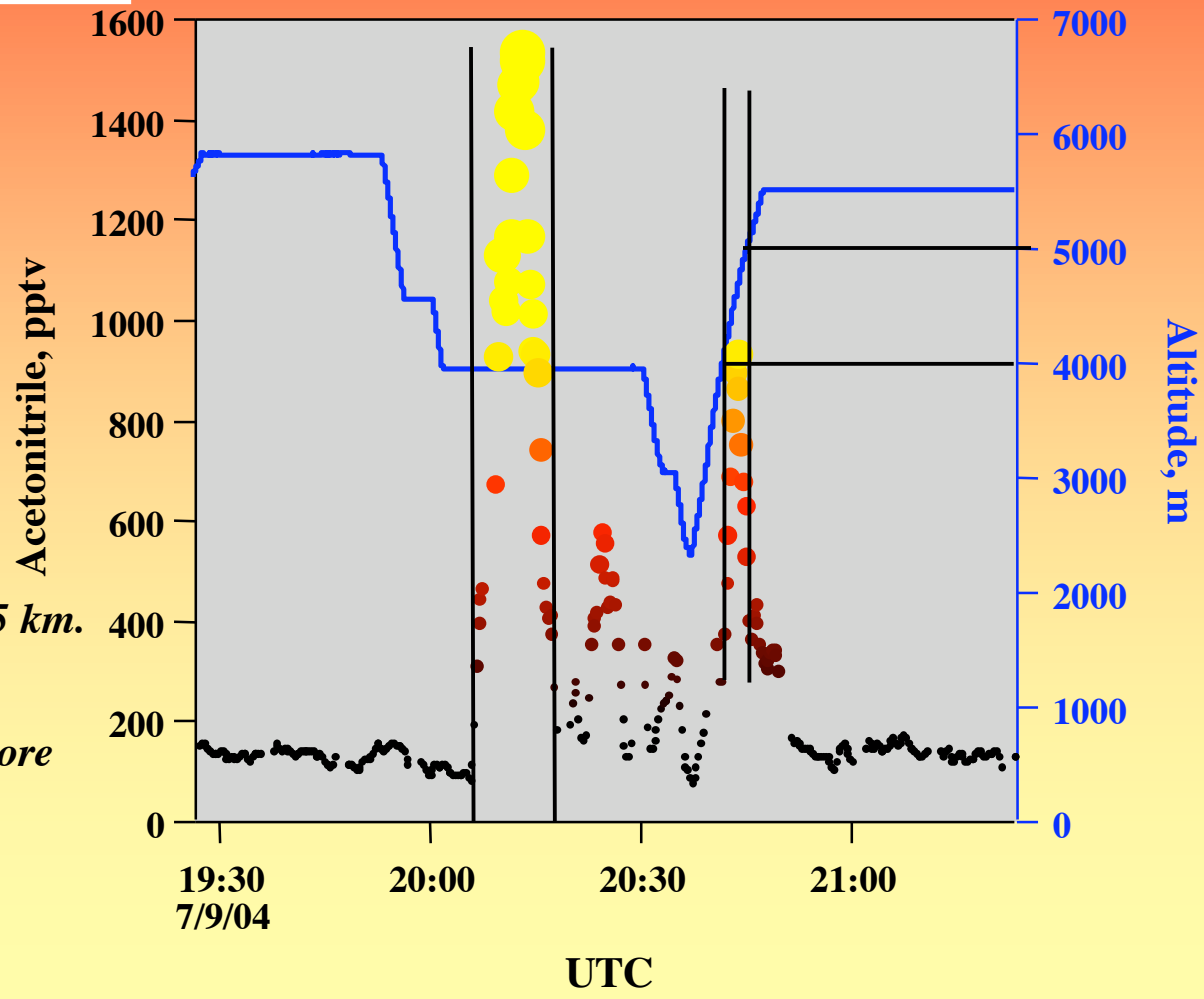
NOAA WP-3D Measurements

Forest Fire Plume 7/9/04

- *The NOAA P3 crossed the plume between 20:06 and 20:20 UTC.*
- *The P3 then doubled back and did a profile through the plume.*

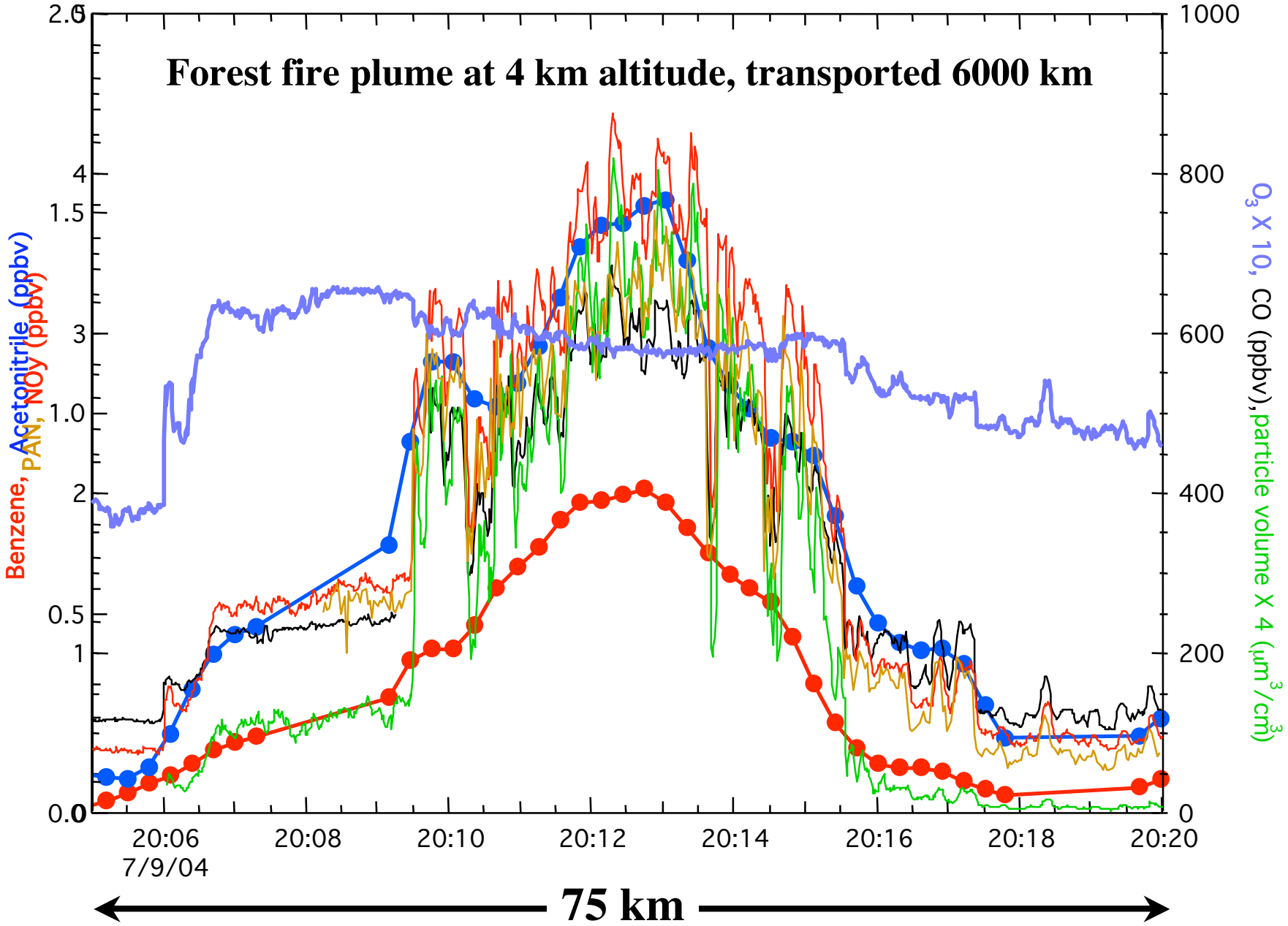




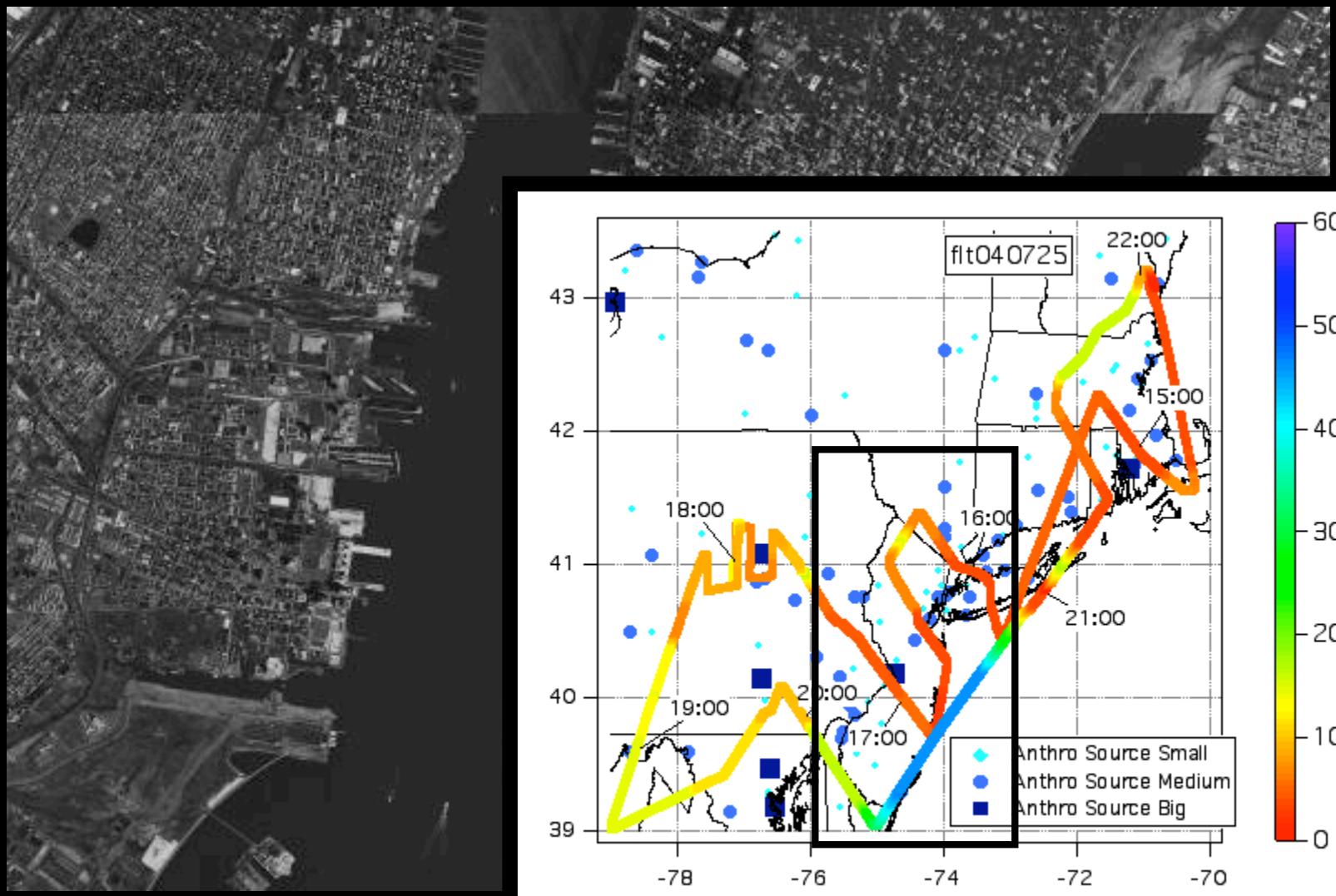


- *The plume was approximately 75 km. wide and one km. thick.*
- *We will look at the crossing in more detail*

NOAA WP-3D Measurements

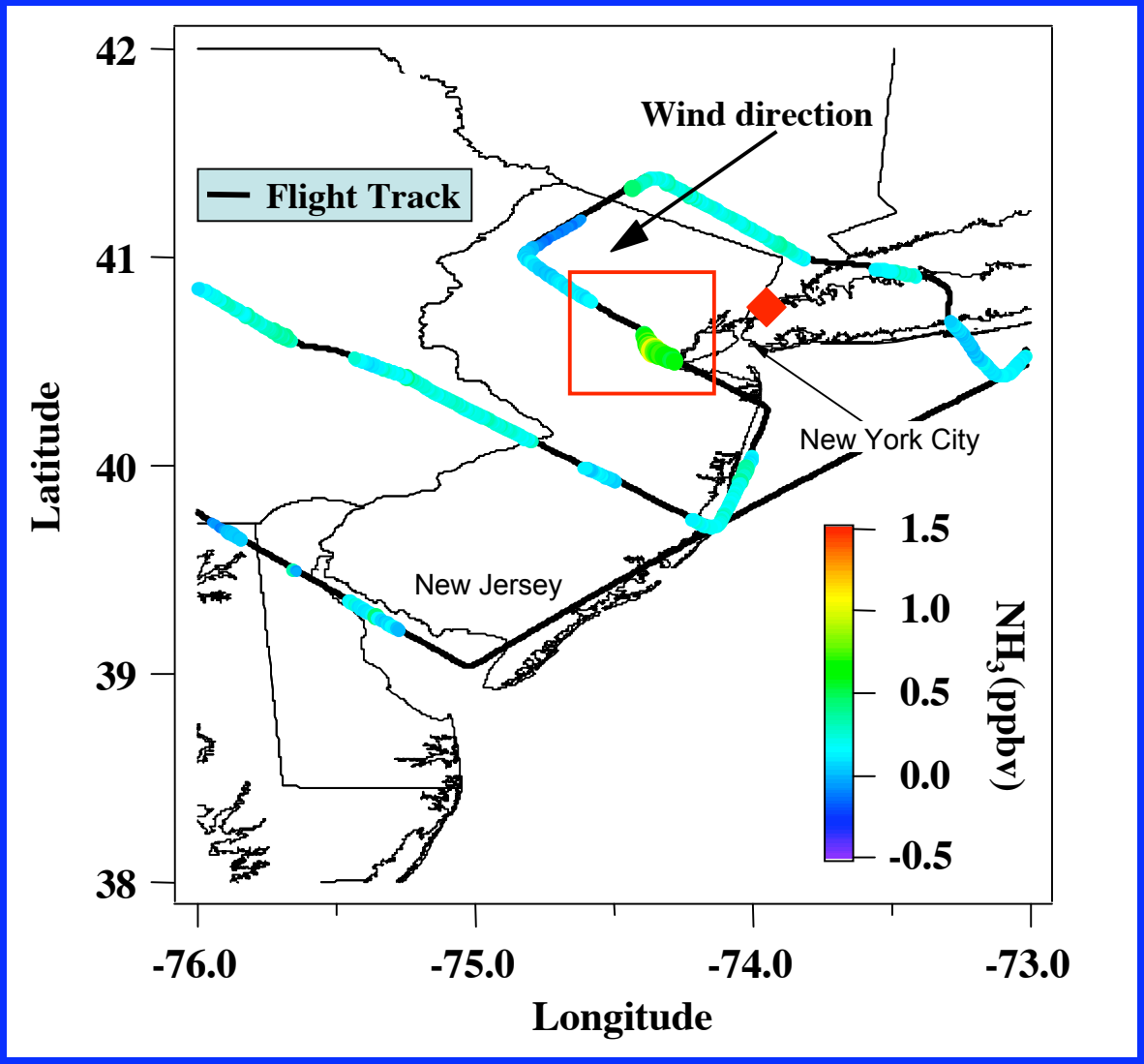


NH_3 in the New York City Plume



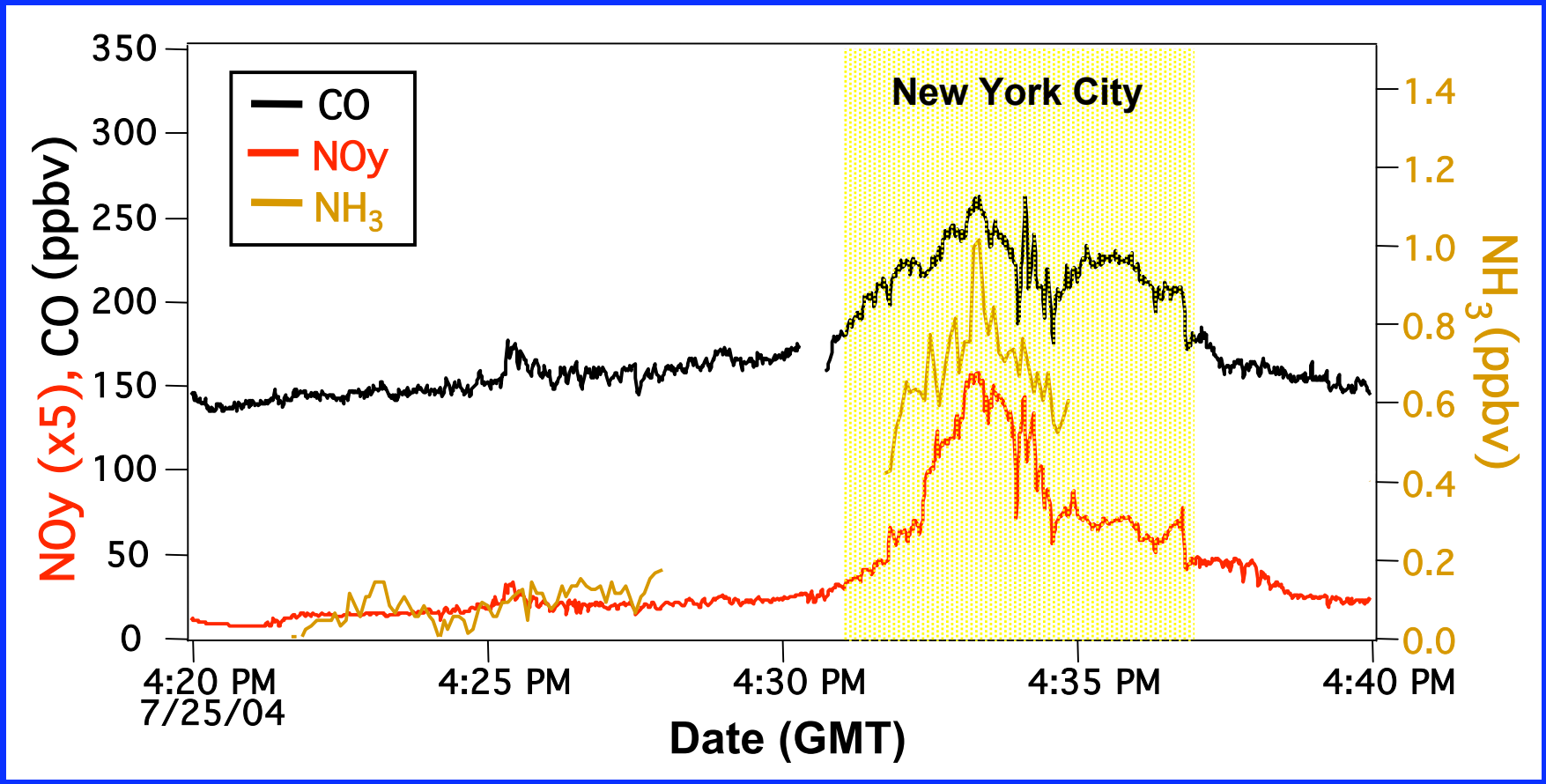
Out first results on the P3 using a recently developed CIMS chemistry

New York NH_3



- July 25th flight downwind of New York City
- Flight track colored and sized by NH_3 mixing ratios.

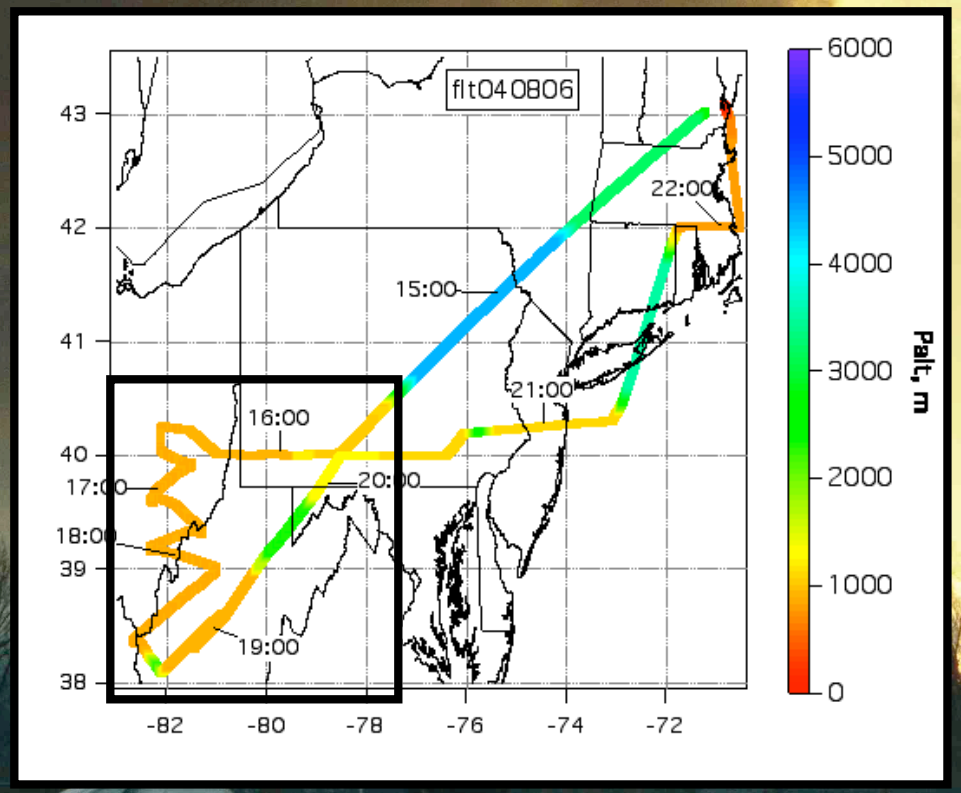
New York NH_3



- Time series shows NH_3 correlated with CO and NOy in New York city outflow.
- NH_3 observed in forest fire, urban, and some power plant plumes.

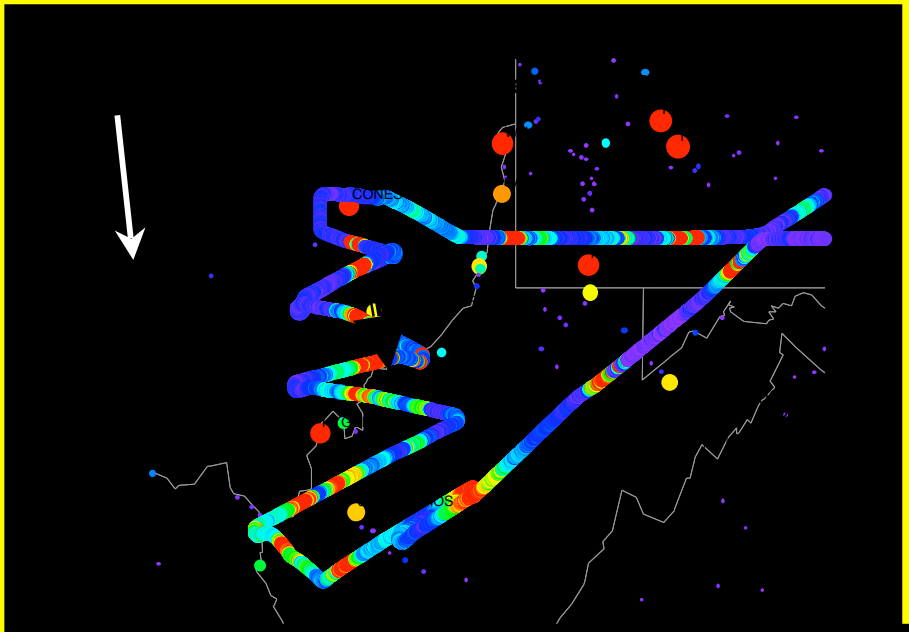
Investigating Power Plant Emissions

The emission from seventeen different power plants were studied.

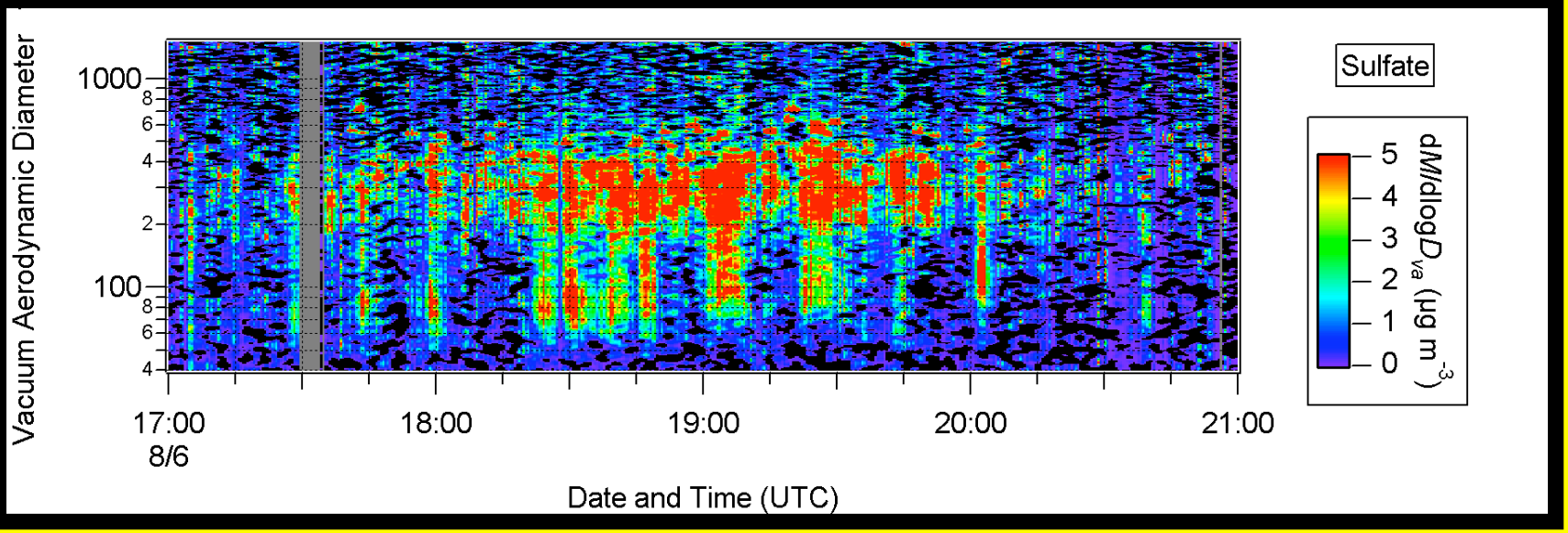


©Peter Essick/Aurora

Power Plants Study: Flight on 8/6/04



- **Daytime flight**
- **Wind from the north-north-west**
- **Power plants and flight tracks are colorized by SO_2 emissions.**



Conclusions from Power Plant Studies

During ICARTT, we obtained the plumes from several power plant on different days plumes at different stages of chemical evolution. Near the plant:

- **High levels of aerosol sulfate were measured (often more than 15 μg/m3).**
- **Most (>90%) of the total sulfur was still in SO_2.**
- **Very little ammonium -> acidic particles**
- **Very little organic mass -> probably not enough precursor.**

As the plumes aged:

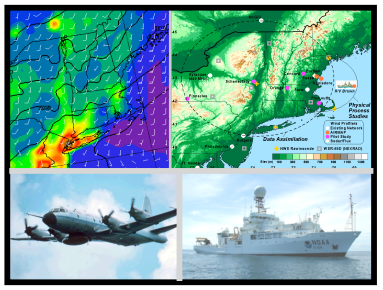
- **Particle sizes increase, due initially to sulfate increases.**
- **Further downwind, aerosol ammonium and organic mass increases.**
- **When clouds were present, cloud processing rapidly converted SO_2 into aerosol sulfate.**

Findings: We made measurement in plumes downwind of several power plants that had revised their emission inventories (EI) since 1999. The result:

- **2003 E(NO_x) ~ 50% 1999 E(NO_x)**
- **2003 E(SO_2) ~ 85% 1999 E(SO_2)**
- **Updated EI agrees with observations**

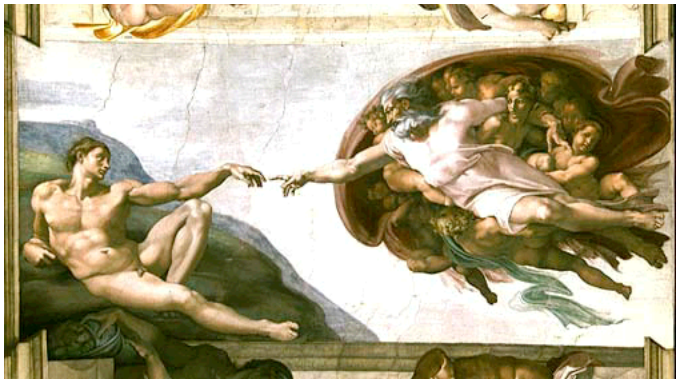
SUMMARY

NOAA:ICARTT-2004)



We established broad goals for the study that we were able to accomplish. Some important finding are:

- ***It's a whole new day for the night!***
- ***Sulfate dominated the exported fine particle mass.***
- ***The aerosols measured after long-range transport were largely neutralized.***
- ***We have obtained a wealth of new information about the transport and chemical transformation processes that are occurring in forest fire emissions.***
- ***Nitric acid and aerosols can be efficiently scavenged by clouds.***
- ***NH_3 was measured (a first for the P3) in urban, forest fire and some power plant plumes.***
- ***Air quality has significantly reduced the emission of NO_x and SO_2 from power plants in the Northeast.***



We stand ready to share our results with our study partners.